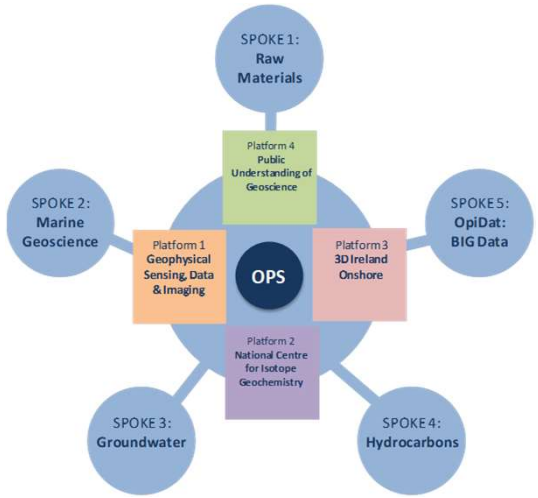
Marine Geoscience

Funded Investigator:
Tim McCarthy, Maynooth University

Marine & Coastal Observation Platform for Offshore E&P Activities

MarObs Platform



Ireland's European Structural and Investment Funds Programmes 2014-2020
Co-funded by the Irish Government and the European Union

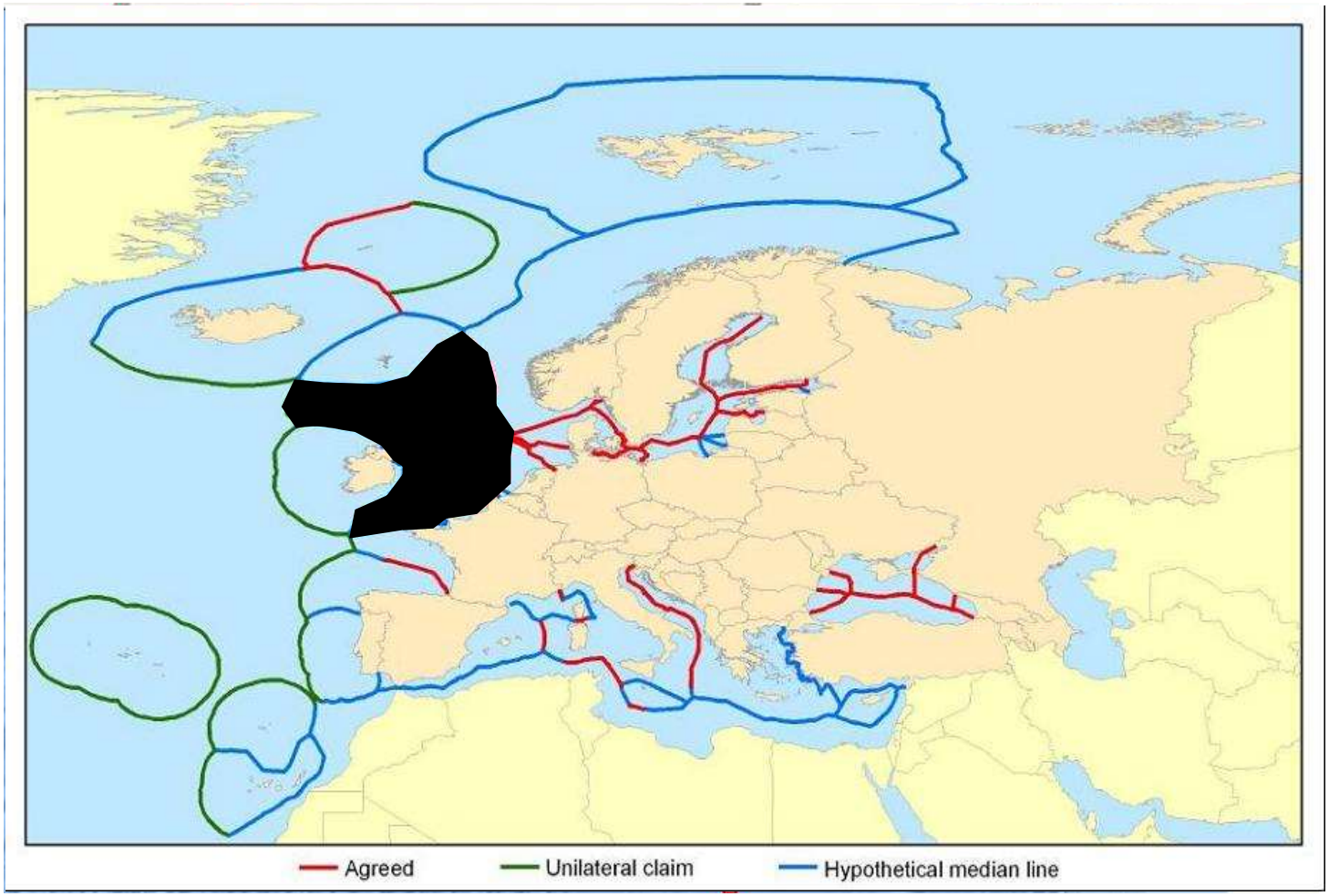
European Union
European Regional Development Fund

Science Foundation Ireland sfi For what's next

PIP Petroleum Infrastructure Programme

This research is supported in part by a research grant from Science Foundation Ireland (SFI) under Grant Number 13/RC/2092 and co-funded under the European Regional Development Fund and by PIPCO RSG and its member companies.

iCRAG Marine Observation Platform



Why a Marine Observation Platform

- 88m ha Marine Territory
- 3,000km Coastline
- Offshore Exploration & Production
- Natural Marine Resources
- Dynamic Coastal Processes
- Climate Change
- [1]EU Maritime Spatial Planning
- Support Risk-Reduction, Resource-Allocation & Optimisation

[1]EU Directive http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0089

Geospatial Information Requirements : Spatial, Thematic & Temporal Attributes

Coverage & Resolution

Spaceborne

100km/20m

10km/20cm

Airborne

1km/2cm

100m/1cm

Terrestrial/Surface

Spatial

Optical, Geometric & Structural

RGB

Multispectral

LiDAR

Hyperspectral

GPS/IMU

GPR

Thematic

Timeliness

Years

Months

Weeks

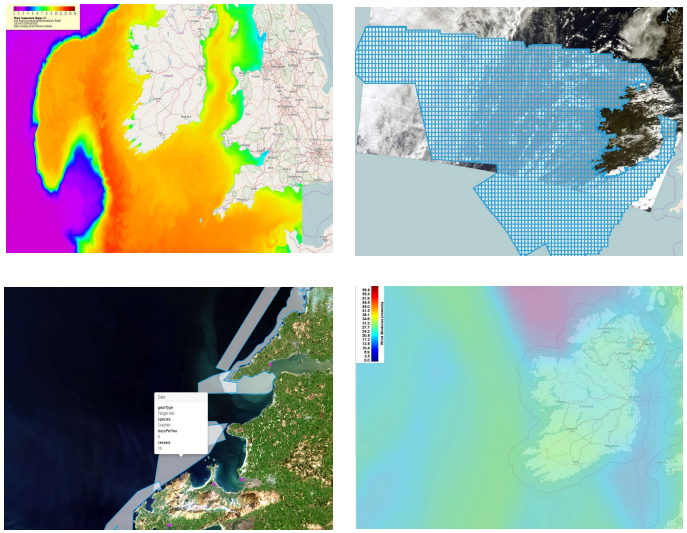
Days

Hours

Real-Time

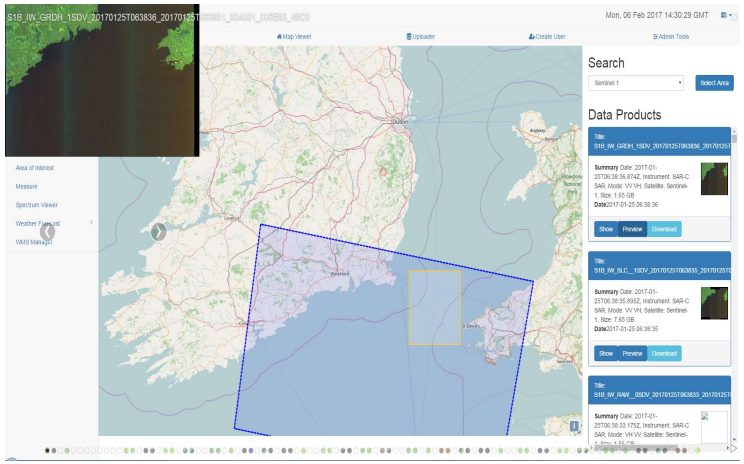
Temporal

MarObs Platform (http://marobs.eu/)



MarObs Architecture: Scalable, Cloud-based platform incorporating; Open Data and collaborative environment to develop algorithms, toolsets and workflows based around **Open Standards** & **Open Source** modules

Project Collaboration: Project configuration, user-management, prototype development



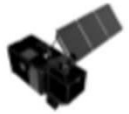
Data Discovery: Platform incorporates wide selection of data; Remote Sensing, E&P, infrastructure, environmental & meteorological data.

Prototype Services & Toolsets : Slick Feature Mapping, Coastal Zone monitoring, Marine Emergency Response

Researcher: Daire Walsh (PhD candidate, MU)

Copernicus for E&P

Sentinel-1 (693km, Polar)



Sentinel-2 (786km, Polar)

Sentinel-3 (815km, Polar)

Sentinel-4* (Meteosat, Geostationary)

Sentinel-5* (MetOp, Polar)

Sentinel-5P (824km, Polar)

*not launched yet

Copernicus is a European Union Programme aimed at developing European information services based on satellite Earth Observation (EO) and in situ (non-space) data. More Information : **http://www.copernicus.eu/**

EO Data & information is freely available

Sentinel Satellite	Details
Sentinel-1	Satellites (S1A & S1B) now operational. All weather day/night synthetic aperture radar (SAR) for land and ocean services, 3 day revisit possible. Strip map (80km swath 5m resolution), Interferometric Wide (250km swath, 5m* 20m), Extra Wide (400km 20m* 40m)
Sentinel-2	Satellites (S2A & S2B) now operational, multispectral data for land, soil, water and coastal applications, 3 day revisit possible. 13 spectral bands (10m to 60m)
Sentinel-3	Satellite S3A launched. Optical, Radar and altimetry data for marine and land services, 2 to 3 days revisit possible, 21 spectral bands (300m)
Sentinel-5P	Satellite S5P launched. Monitoring of tropospheric pollutants and GHGs
Sentinel-4	To be launched. Atmospheric composition monitoring
Sentinel-5	To be launched. Atmospheric composition monitoring
Sentinel-6	To be launched. High accuracy altimetry for sea-surface height measurement

Copernicus Open Data Access hub & Information Services

Copernicus Open Access Data-hubs

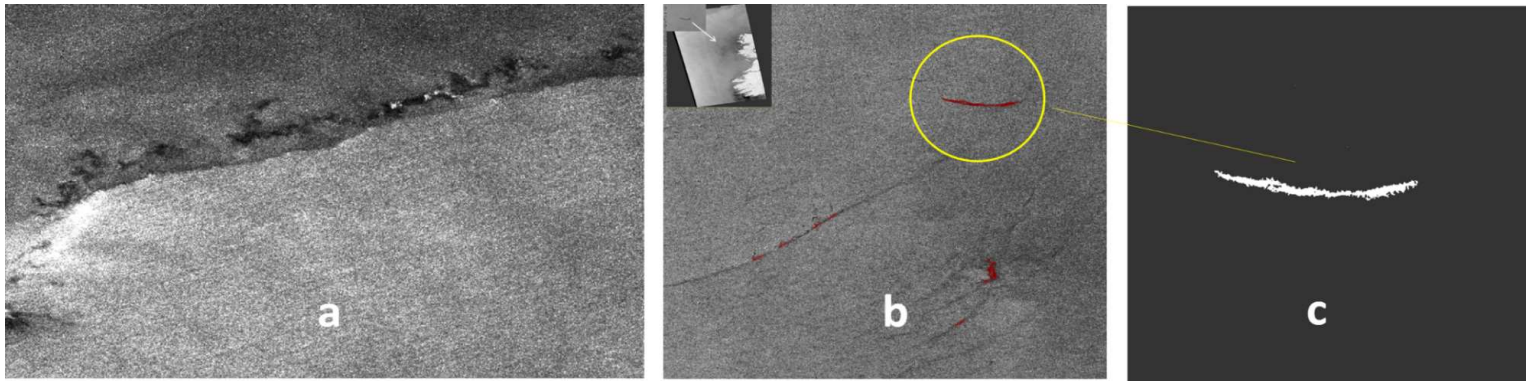
Copernicus satellite image data can be accessed directly through portals such as Copernicus's Open Access hub (https://scihub.copernicus.eu/) which facilitates access to Sentinel-1, Sentinel-2 & Sentinel-3 data.

The European Commission (EC) has launched an initiative to develop Copernicus **Data and Information Access Services (DIAS)** that will facilitate access to Copernicus data and information from the Copernicus services. Various European Member States are also active in developing their own **National EO hubs**.

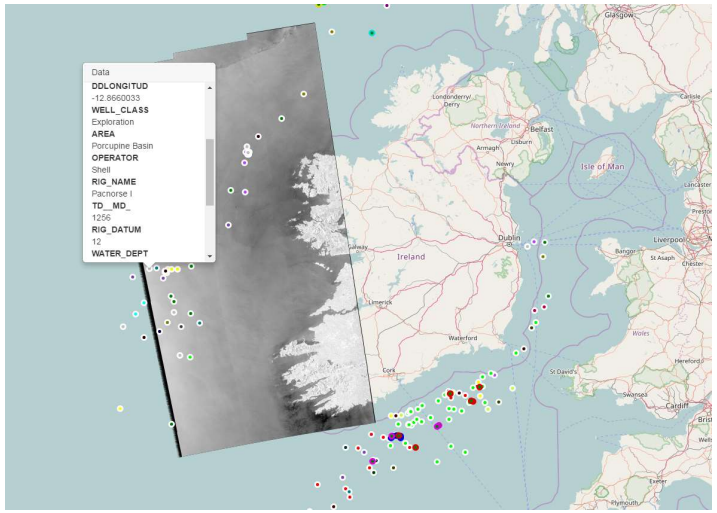
Copernicus Information Services

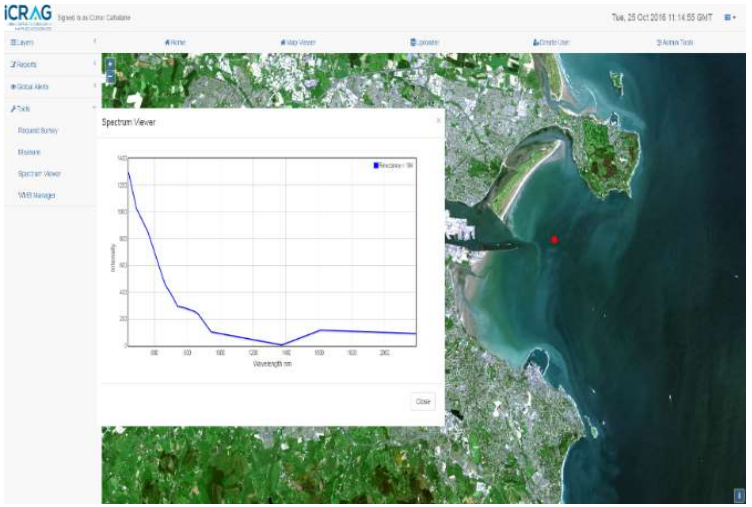
Copernicus provides value added information outputs through six thematic services; **Land, Marine, Atmosphere, Emergency, Climate and Security**. These services are generally accessible by all except for those services that may be restricted for example, security sensitive applications.

Slick Feature Mapping



Locate and measure extents of slick using SAR (Sentinel-1)





<u>Research:</u> Detect and categorise slick offshore Ireland using Spaceborne/Airborne Optical/non-Optical data

<u>End-Users:</u> Offshore Hydrocarbon Industry, Coast Guard, Harbour Agencies, Environmental Regulatory Agencies

Researcher: Dr Conor Cahalane, MU

PIP Petroleum Infrastructure Programme

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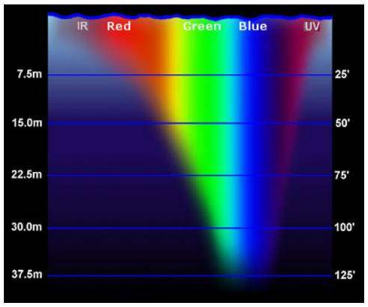
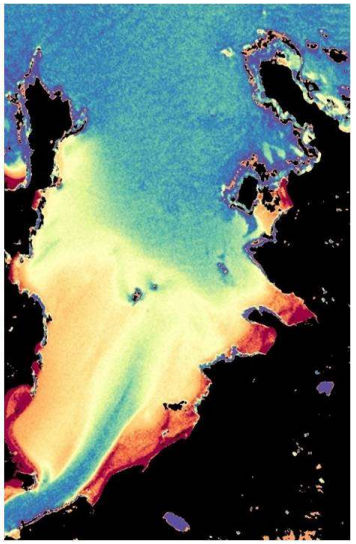
Satellite Derived Bathymetry

Mapping near-shore bathymetry using optical non-contact satellite measurements





<u>Research</u>: Developing combined Remote Sensing and Geo-statistical methodologies for near-shore bathymetric mapping close to Ireland's coastline

<u>End-Users:</u> Offshore Hydrocarbon Industry, Harbour Agencies, National maritime mapping organisations

GSI
Geological Survey of Ireland
Suirbhéireacht Gheolaíochta Éireann

Researchers: Dr Gema Casal and Dr Conor Cahalane, MU

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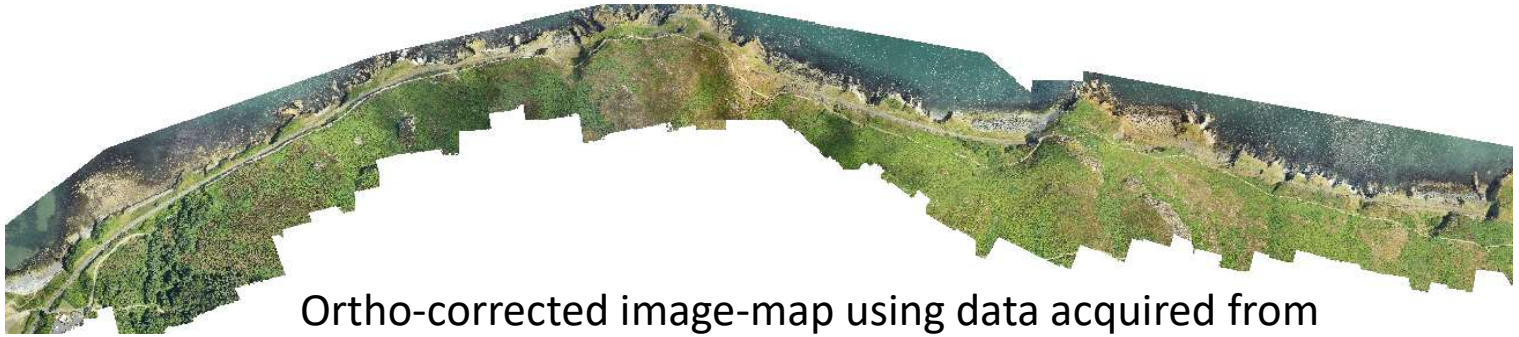
Coastal Erosion



Ortho-corrected image-map using data acquired from airborne/drone platforms (Bray – Greystones)

Photogrammetric derived point cloud providing elevation (2.5D RGB values)

Research: Develop data fusion techniques for coastal monitoring around Ireland based on RGB, Multispectral & Hyperspectral sensor data

End-Users: Offshore Hydrocarbon Industry, Marine Mapping Organisations, Local Authority, Infrastructure Agencies

Researcher: Aidan Magee (PhD Candidate, MU)

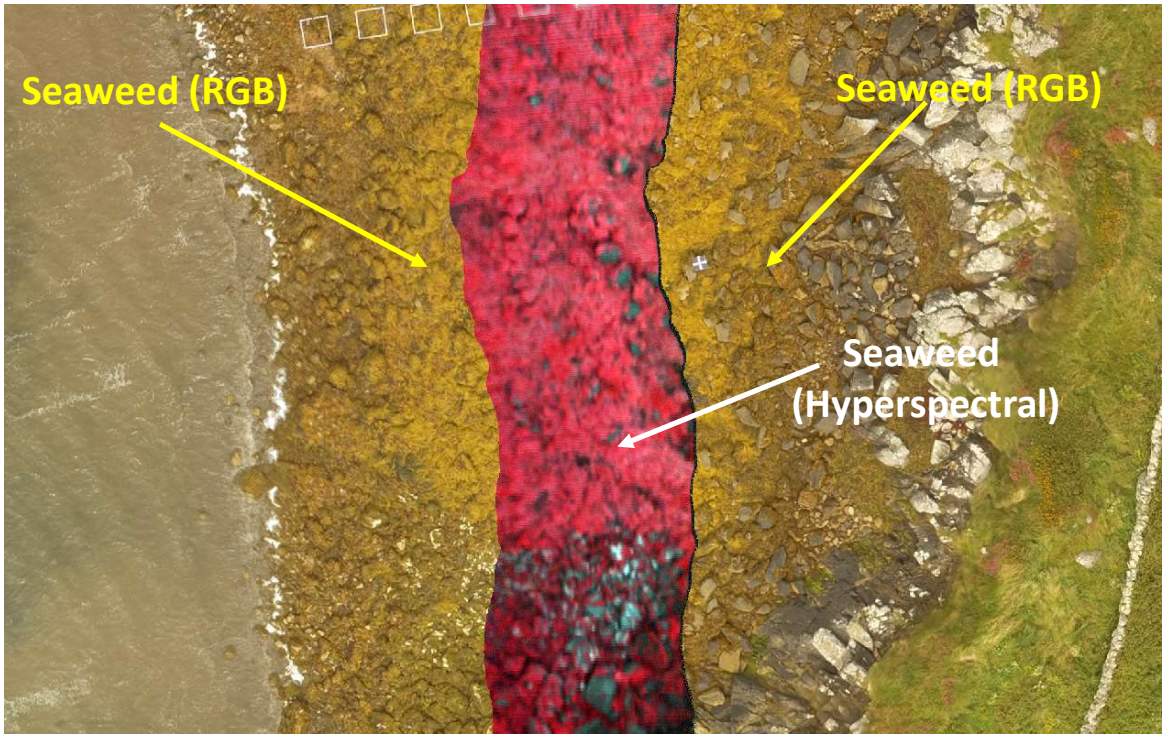
Burrishoole

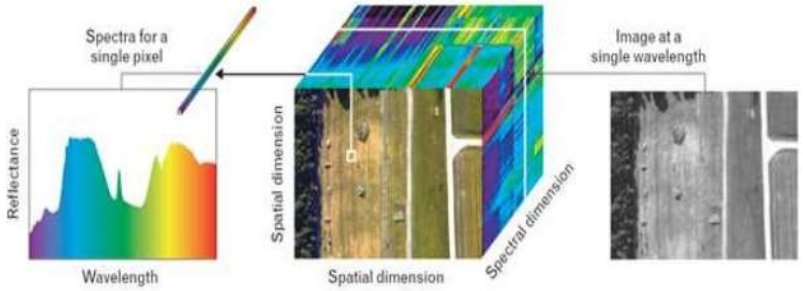
Research: Monitoring and mapping inter-dependent physical, biological and chemical processes within a coastal catchment

End-Users: Hydrocarbon Industry, Regulatory Agencies, Local Authority, Environmental Monitoring Industry

Researcher: DCU, DKIT, & UCC

Coastal Vegetation Mapping & Hyperspectral Sensors





<u>Bayspec Hyperspectral OCI-F</u>
Mode : Push Broom
Spectral Range : 400nm – 950nm
Spectral Bands : upto 110

Researcher: Tom Rossiter, PhD Candidate NUIG

Maritime Spatial Planning

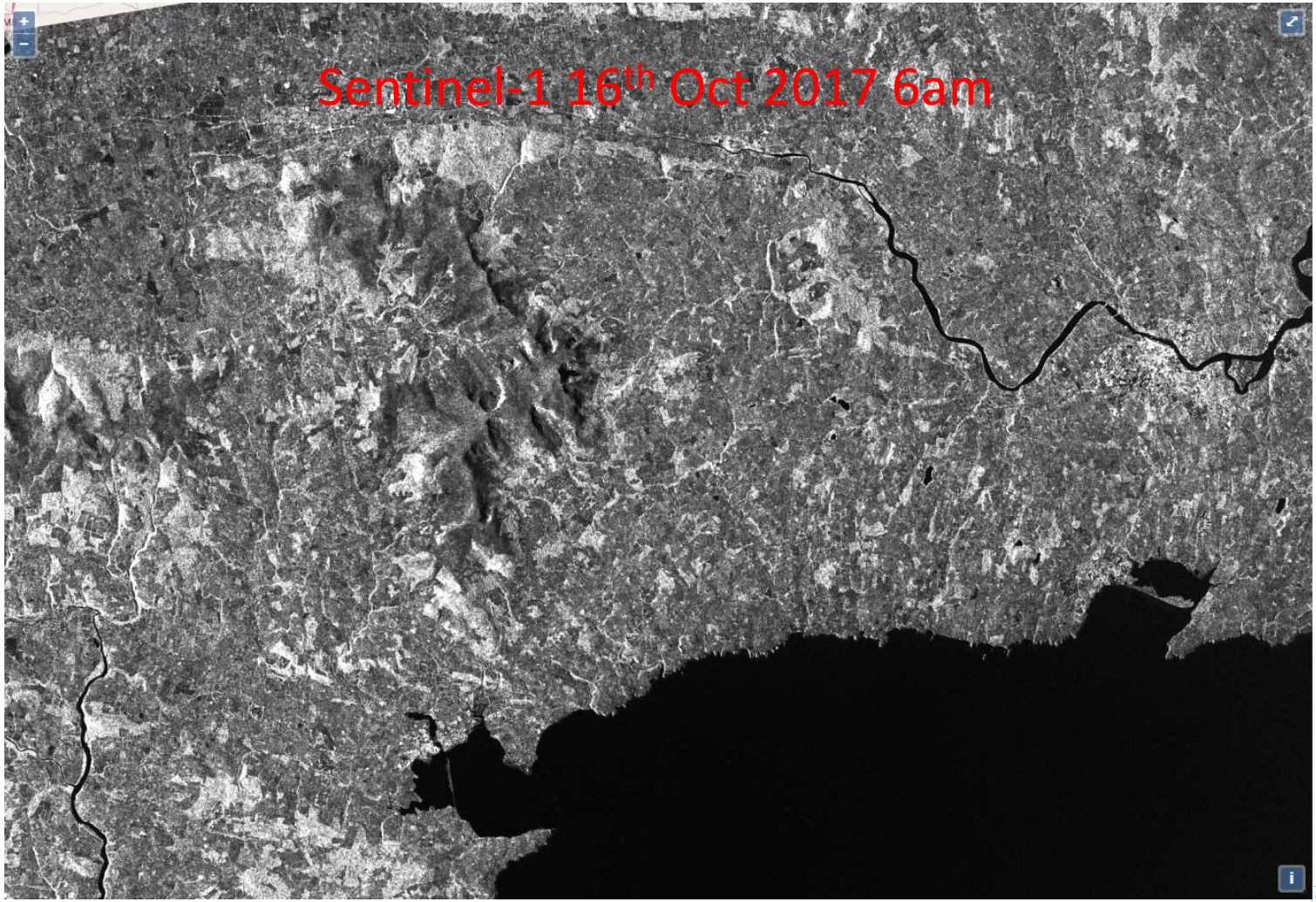
09-Mar-2017

Multi-temporal 10m Sentinel 2 (May 2016 – March 2017)

Research: Multi-temporal, multi-platform data for high value Marine-port, harbour and installation monitoring

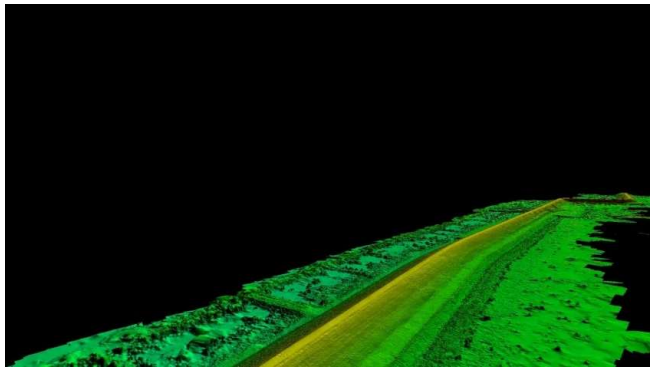
End-Users: Offshore Hydrocarbon Industry, Harbour Agencies, Local Authority, Infrastructure Managers

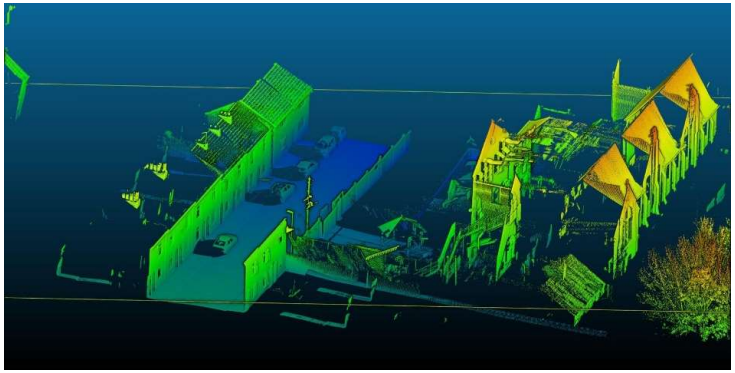
Sentinel-1 ex-Hurricane Ophelia 16th Oct 2017



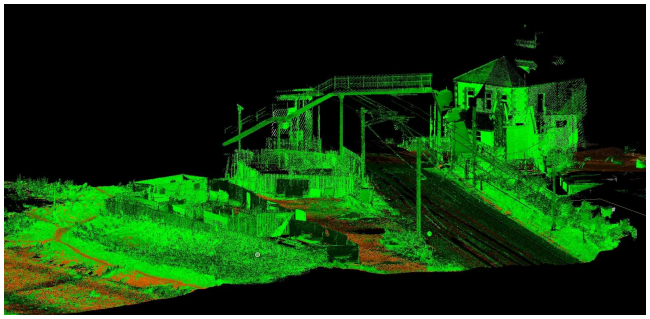
Location Map

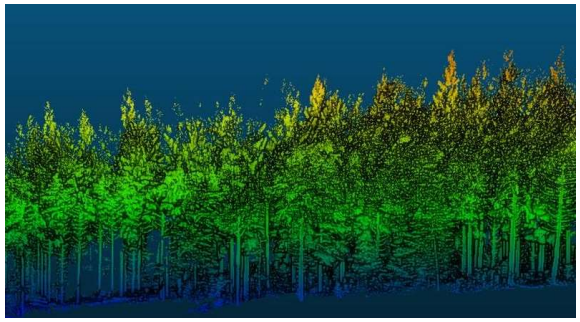
Airborne/Drone LiDAR Systems (Riegl Vux)





LiDAR Point Cloud





Additional Drone LiDAR Sensors : Velodyne, YellowScan

Riegl MinVux-1DL

- Compact : 2.4Kg
- Field of View: 46°
- Acq Rate : 100kHz
- Scan Spd: 150 Hz
- Upto 120m Range

MarineWatch Demonstrator

End-Use Case #1 : Irish Coast Guard

• handle 2,500 marine emergencies, assist 4,500 people and save 200 lives

• task Coast Guard helicopters on missions around 800 times (40 times to assist mountain rescues and 150 times to carry out aeromedical HEMS missions on behalf of the HSE)

• Coast Guard volunteer units will respond 1000 times and RNLI and community lifeboats will be tasked by our Coordination Centres about 950 times;

• investigate approximately 50 maritime pollution reports

Irish Coast Guard
GARDA CÓSTA na hÉIREANN

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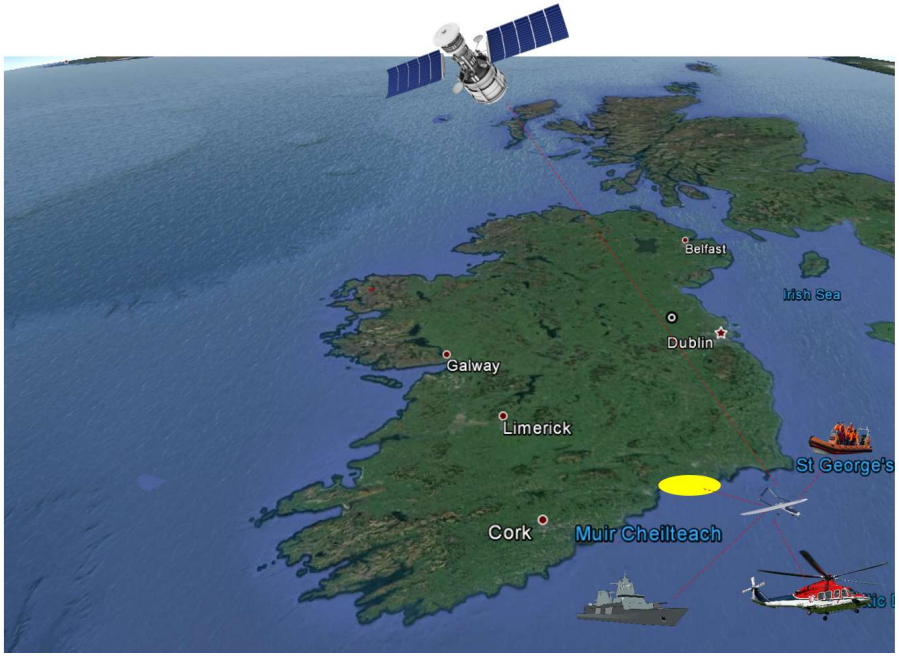
MarineWatch Demonstrator

<u>Operation</u>

- Platform, Payload, Performance
- Safety, Regulatory, Compliance, Security
- Connectivity (Downlinks, Telemetry, C2)
- Reliability & Complexity
- Integrated Multi-agency response



<u>R&D Topics</u>

- Maritime Surveillance (Spaceborne/Drone/InSitu)
- Multi-platform Sensor Fusion
- Optimised Search & Tracking
- Collaborative Operation
- Water sampling for pollution monitoring

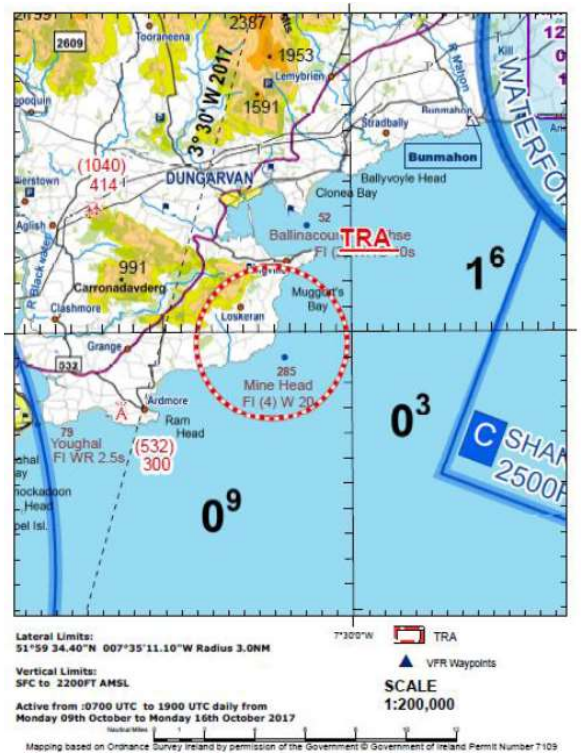
<u>Business Case</u>

- Risk Reduction, Better Information, Improved Decision making
- Automation of manual tasks, More cost effective, Reduce risk & exposure to staff
- Improved overall outcomes: Risk-reduction - Reduced injuries/fatalities per event

MarineWatch Demonstrator

Phase-1, Minehead Light-house 9th – 13th Oct 2017

Temporary Restricted Area (TRA)



Minehead Lighthouse)

Minehead Lighthouse)

Ground elevation 61m, Tower height 21m